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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 :
A61F 13/02, 13/15

A1

(11) International Publication Number: **WO 94/20054**

(43) International Publication Date: 15 September 1994 (15.09.94)

(21) International Application Number: PCT/SE94/00150

(22) International Filing Date: 23 February 1994 (23.02.94)

(30) Priority Data:
9300683-1 1 March 1993 (01.03.93) SE

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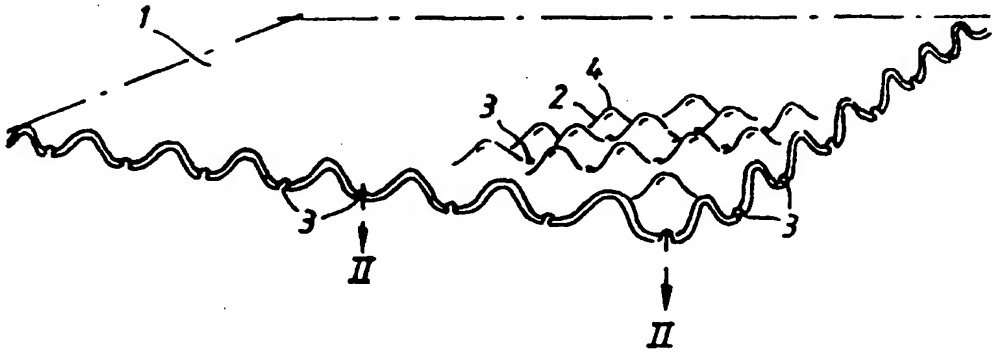
(81) Designated States: JP, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.

(54) Title: SURFACE MATERIAL FOR ABSORBENT ARTICLES



(57) Abstract

The present invention relates to surface material (1) for absorbent articles such as diapers, sanitary napkines, incontinence guards and wound dressings, this surface material being intended to lie proximal to the wearer's skin in use. According to the invention, the surface material (1) includes a plurality of projections (2) on that side of the material which lies proximal to the wearer's skin in use, and a plurality of through-penetrating perforations (3) in regions lying outside the projections. The invention also relates to apparatus for manufacturing such surface material.

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Surface Material for Absorbent Articles

The present invention relates to surface material for absorbent articles, such as diapers, sanitary napkins, incontinence guards and wound dressings, said surface material being intended to lie proximal to the user's skin when the article is worn.

This type of surface material is intended to enhance the comfort with which the absorbent articles can be worn and so that the surface of the article that lies against the wearer's skin will be felt to be dry and comfortable. Functionally, this implies that the material shall not irritate the skin, that the surface layer shall coact with an absorbent body that lies outwardly in relation to the skin of the wearer in a manner such that fluid will be quickly transported away from the surface material and into the absorbent body, and that fluid absorbed by the body will be unable to pass back to that side of the surface material which is proximate to the skin. In addition, the surface material will also have a textile-like structure, since it has been found that the users of such articles prefer to have a textile-like material closest to the body.

In recent times, perforated plastic film has been used more and more as the surface material in absorbent sanitary products and absorbent hygiene products. One such known plastic film or sheet is comprised of a flat sheet in which there is formed a regular pattern of conical pits, each of which has a hole formed in the bottom surface thereof. This material thus has a flat side and a "spiky" side. When an absorbent article which includes such material is worn, the spiky side of the sheet faces towards the absorbent body of the article while the flat side lies against the wearer's skin. Such material can be manufactured cheaply and also provides a dry surface. The pits

function as capillaries so that fluid discharged by the wearer will be sucked into the absorbent body, and the conical shape of the pits is considered to provide some sort of check-valve function which prevents fluid from passing back through the surface material when the article is subjected to pressure. One drawback with this surface material, however, is that the flat side of the material lies against the wearer's skin, meaning that moisture, such as perspiration, will be enclosed between the wearer's skin and the surface material, at least on the planar parts of the flat side, i.e. on those parts of the surface material which lie outside the pits.

An object of the present invention is to provide an absorbent article surface material which, when the article is worn, will provide good ventilation between the wearer's skin and the surface material and which also has good properties in other respects.

This object is achieved in accordance with the invention in that surface material of the kind defined in the introduction is characterized in that said material includes a plurality of projections on that side thereof which is intended to lie proximal to the wearer's skin in use, and in that through-penetrating perforations are formed in those parts of the surface material which lie externally of the projections. Because only the tops of the projections lie against the wearer's skin, the major part of the surface material will be distanced from the skin of the wearer and ambient air is able to flow freely between the wearer's skin and the surface material. In addition, the total contact surface area of the surface material with the skin is small, which further enhances the comfort of a person which wears an absorbent article that includes such surface material.

According to one advantageous embodiment, the projections on the surface material have rounded tops, and the projections and the perforations are disposed in a regular pattern across essentially the total surface area of the surface material. The projections are also hollow, have a greater material thickness at their tops than at the remainder of the projections and have an upwardly narrowing shape. As a result of this configuration, the projections will lie in essentially punctiform contact with the wearer's skin, even when an absorbent article provided with inventive surface material is subjected to pressure, and the deformation forces will be distributed over a relatively large part of the walls of the projections.

The invention also relates to apparatus for manufacturing surface material for absorbent articles, such as diapers, sanitary napkins, incontinence guards and wound dressings, said surface material being intended to lie proximal to the wearer's skin when the article is worn, characterized by a mould which includes a regular pattern of conical or pyramidal bodies which project up from a smooth surface and which have rounded top surfaces, and in which holes are located in the smooth parts of the mould externally of the bodies, and which further includes means for placing on top of the mould a flat plastic sheet which has been heated to a mouldable state and means for generating a subpressure in the proximity of the holes in the mould.

The invention will now be described in more detail with reference to the accompanying drawings, in which

Fig. 1 illustrates part of a surface sheet constructed in accordance with one preferred embodiment of the invention;

Fig. 2 is a sectional view taken on the line II-II in Fig. 1;

Fig. 3 illustrates schematically apparatus for producing the surface material illustrated in Fig. 1;

Fig. 4 is a schematic perspective view of one embodiment of a mould that can be used for the manufacture of inventive surface material; and

Fig. 5 is a schematic sectional view of two mutually adjacent projections on the mould illustrated in Fig. 4.

The surface material illustrated in Figures 1 and 2 is comprised of a plastic sheet 1, for instance a polyethylene sheet, which includes a plurality of conical projections 2 on one side thereof, as illustrated schematically in Figure 1. Perforations 3 are formed in the surface material in the flat regions between adjacent projections 2.

As mentioned earlier, the surface material is intended for use in absorbent one-time use articles, such as diapers, sanitary napkins, incontinence guards and wound dressings, with the side of the material on which the projections are provided being intended to face towards the wearer's skin and with the flat side of the material facing towards the absorbent body in the article concerned. When using an article which includes inventive surface material, only the tops 4 of the projections will lie against the wearer's skin. The surface material will thus abut the skin of the wearer solely in a punctiform fashion, and the skin contacting area of the surface material will therefore be very small, therewith preventing moisture from being enclosed between the skin and the surface material. Ambient air is also able to flow freely to the space between the surface material and skin, therewith purging this space of any moisture, such as perspiration, which may be present. Furthermore, when fluid is discharged in large quantities, such as urine, the

absorbent body of the article coacting with the surface material is able to take-up the fluid in a conventional manner, because the fluid will flow into the areas between the projections on the surface material and through the perforations 3 in said areas and be absorbed by the absorbent body. The ventilation effect achieved with the inventive surface material will cause an absorbent article provided with such surface material to be felt very comfortable when worn.

When the inventive surface material is used in wound dressings, the ventilation effect will facilitate wound healing while the small total contact surface of the material will greatly reduce the tendency of the material to adhere to the wound.

The fluid permeability of the plastic sheet 1 is determined by the number and the size of the perforations 3, and the chosen ratio between open area per m^2 plastic sheet corresponds to the values of known perforated sheets intended for corresponding use.

In order for the surface material to function in the intended manner, the projections must be rigid enough to withstand the pressures to which the absorbent article comprising said surface material is normally subjected in use, without collapsing so as to block the air passageways between the projections. On the other hand, the projections must not be so rigid as to press hard against the wearer's skin when subjected to pressure and therewith feel uncomfortable.

In view of this, the projections 2 are hollow and the tops 4 of the projections 2 are preferably rounded, and even more preferable spherical in shape. In this way, when an absorbent article that is provided with surface material according to Figures 1 and 2 is subjected to pressure the forces acting on the wearer's skin will be distributed over a wider surface

area than when the tops are pointed. The top 4 of a projection may also advantageously have a greater wall thickness than the remainder of the projection, which means that any deformation of the projection will begin away from the top and that deformation load will be distributed over a relatively large part of the projection wall via the top.

The height of the projection will preferably be chosen to be smaller than the diameter of a free droplet contained by the surface tension of the fluid to be absorbed by the absorbent body with which the surface material coacts, so as to ensure that droplets of discharged fluid will not remain in the projection interstices.

Figure 3 is a schematic cross-sectional view of part of an apparatus for producing the aforedescribed surface material. The apparatus includes a flat mould 5 which has a pattern of outwardly projecting conical bodies 6 whose outer contours are complementary to the shape of the projections 2 to be formed in an initially flat plastic sheet. Holes 7 are provided in the planar parts between the bodies 6 and are connected to a vacuum box 8.

When manufacturing inventive surface material, a plastic sheet 1 which has been heated to a mouldable state is placed on top of the mould 5 so as to rest on the tops of the upstanding bodies 6 of the mould, as indicated in chain lines in Figure 3. The underside of the plastic sheet is then subjected to subpressure with the aid of the vacuum box 8. The plastic sheet is sucked down towards the bottom of the mould 5 by the subpressure generated by the box 8 while being plastically deformed, until the sheet rests on the mould bottom. Plastic material is then drawn through the holes 7 in the mould and ruptures to form the afore-

said perforations 3. By appropriate dimensioning of manufacturing parameters, such as plastic sheet temperature and the value of the subpressure, surface material manufactured in this way can be given a greater wall thickness at the tops of respective projections than in the remainder of the projection walls, because the plastic sheet will begin to solidify at the tops of the mould body 6 immediately it is placed thereon.

The sheet manufacturing apparatus is preferably constructed to produce continuous webs of surface material, wherein the plastic sheet is applied to a mould according to Figure 3 formed on the periphery of a suction drum directly from an extrusion nozzle. The suction drum may be provided with two vacuum boxes arranged sequentially in the movement direction of the plastic sheet, of which boxes the downstream vacuum box will have a greater capacity than the upstream box so that the desired subpressure can be maintained even when sheet material has ruptured after having passes into the holes 7 in the mould.

Figures 4 and 5 illustrate schematically another mould 9 which can be used in the inventive apparatus and in which the holes are produced in the surface material either by punching or with the aid of an ultrasonic horn.

The mould 9 is also formed in the periphery of a suction drum, as illustrated in Figure 4 which illustrates schematically a section of the mould 9. Distinct from the mould 5 illustrated in Figure 3, the mould 9 includes bodies 10 which project in a regular pattern radially inwards from the periphery of a cylindrical surface instead of radially outwards as in the case of the mould 5. The bodies 10 have a truncated pyramidal configuration and the walls of said bodies include a plurality of holes 11 which open into

the suction box 12 of the suction drum, although this has not been shown in Figure 4 for the sake of clarity. The base lines of the pyramids extend in an intersecting, diagonal pattern around the outer cylindrical surface of the mould 9 and the mould 9 has cruciform raised regions 13 between the pyramids at the points of intersection between the pyramid base lines. These raised regions 13 can be easily produced by machining down the outside of the mould 9 externally of the cruciform regions 13.

When using the mould 9 to produce inventive surface material, a sheet of plastic material in plastic state is placed on the mould and a subpressure is applied to the sheet so that the sheet will be drawn into the pyramidal bodies and therewith assume the shape of said bodies. No perforations are made in this stage of manufacture. The mouldable sheet is then caused to harden, optionally by supplying cooling air to the sheet. When the mouldable sheet has hardened, the sheet, while still on the mould 9, is caused to pass a counter-roller or an ultrasonic horn, so as to remove the material on the raised cruciform regions 13 of the mould and therewith form cruciform apertures in the hardened plastic sheet. The use of the mould 9 and a counter-roller or an ultrasonic horn when manufacturing the inventive surface material has the advantage that the amount of energy consumed and the amount of air that must be sucked away is less than when vacuum-forming the holes.

It is also conceivable to manufacture the surface material in a manner other than by vacuum-forming, for instance by passing the material between two moulds having mutually complementary projections and pits. It is also possible to begin with a flat plastic sheet and then heat the sheet to a mouldable state, instead of beginning with a newly extruded plastic melt.

It will be understood that the described and illustrated embodiment of the invention can be modified within the scope of the invention, particularly with respect to the shape of the projections and perforations and with respect to the patterns in which they are arranged. For instance, it is not necessary for that side of the surface material which lies proximal to the absorbent body to be flat, and it is also possible to use materials other than plastic sheet for the surface material. Because of the small contact surface between skin and surface material, not even hydrophilic material will be felt to be wet by a wearer. Plastic sheet is preferred, however, because of its low cost and good shapability. However, the pattern of projections, or possibly a combination of different patterns of projections, will preferably extend over the whole area of the surface material, so as to ensure good ventilation, whereas the pattern or patterns of perforations may be disposed solely in those parts of the surface material in which fluid can be expected to be discharged by the wearer. The invention is therefore only restricted by the content of the following Claims.

Claims

1. Surface material (1) for absorbent articles, such as diapers, sanitary napkins, incontinence guards and wound dressings, said surface material being intended to lie nearest the wearer's skin in use, **characterized** in that the surface material (1) includes a plurality of projections (2) on that side thereof which lies proximal to the wearer's skin in use, and a plurality of through-penetrating perforations (3) in parts that lie outside the projections.

2. Surface material according to Claim 1, **characterized** in that the projections (2) have rounded tops (4).

3. Surface material according to Claim 1 or 2, **characterized** in that the projections (2) and the perforations (3) are disposed in a regular pattern across essentially the whole area of the surface material.

4. Surface material according to any one of the preceding Claims, **characterized** in that the projections (2) are hollow and have a greater material thickness at the tops (4) thereof than in their remaining portions.

5. Surface material according to any one of the preceding Claims, **characterized** in that the projections (2) have an upwardly narrowing shape.

6. Apparatus for manufacturing surface material (1) for absorbent articles, such as diapers, sanitary napkins, incontinence guards and wound dressings, said surface material being intended to lie proximal to the wearer's skin in use, **characterized** by a mould (5) which includes a regular pattern of conical or pyramidal bodies (6) which project out from a smooth surface and which have rounded top surfaces; holes (7) in the

smooth parts of the mould externally of the bodies (6); means for placing a flat plastic film heated to a mouldable state on top of the mould (5); and means (8) for generating a subpressure in the vicinity of the holes (7) in the mould.

7. Apparatus according to Claim 6, **characterized** in that the mould (5) extends around the periphery of a rotary drum with the holes (7) connecting with a vacuum box (8) located inwardly of the periphery of the drum; and in that the apparatus includes an extrusion nozzle which functions to lay plastic sheet in a mouldable state on top of the mould (5).

8. Apparatus for producing surface material (1) for absorbent articles such as diapers, sanitary napkins, incontinence guards and wound dressings, said surface material lying proximal to the wearer's skin in use, **characterized** by a cylindrical mould (9) which includes a regular pattern of conical or pyramidal bodies (10) which project radially inwards from the cylindrical surface of the mould and which have rounded top surfaces which include holes (11), and cruciform promontories (13) which project radially upwards from said cylindrical surface and which have a small radial extension in relation to said bodies and are located in parts of the cylindrical surface that lie outside the bodies (10) and are mutually spaced in peripheral and axial rows, a counter-roller which is intended to lie in a nip against the mould promontories (13); means for placing a flat plastic film heated to a mouldable state on top of the mould (9); and means (12) for generating a subpressure in the vicinity of the holes (11) in the mould.

Fig. 1

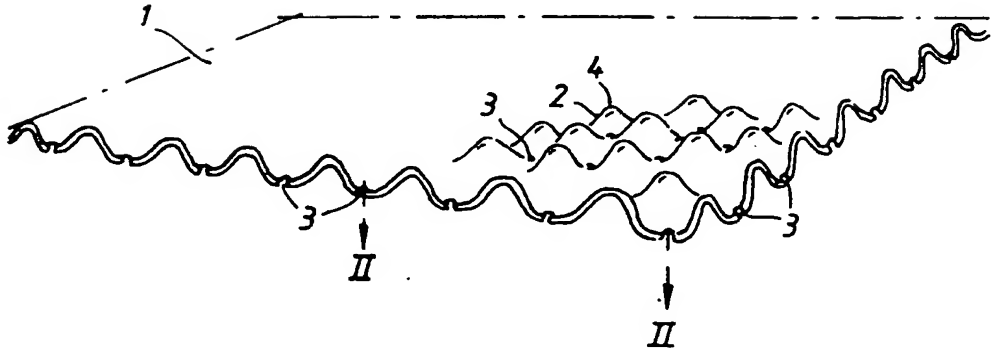


Fig. 2

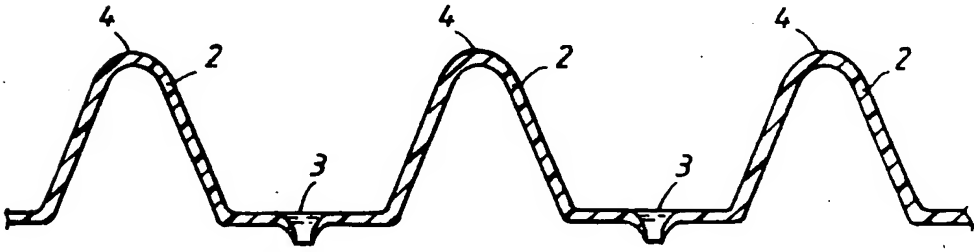


Fig. 3

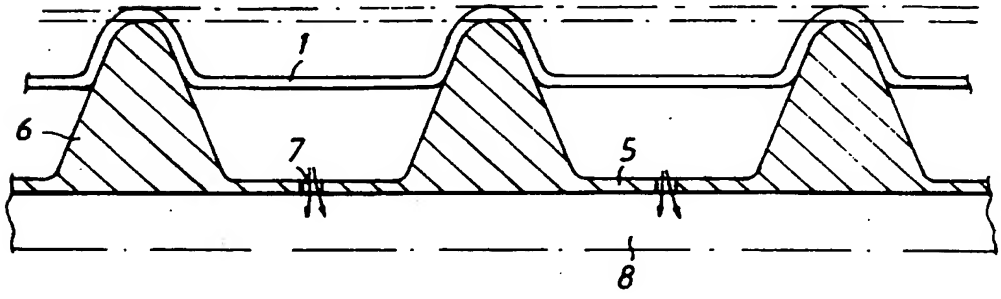


Fig. 4

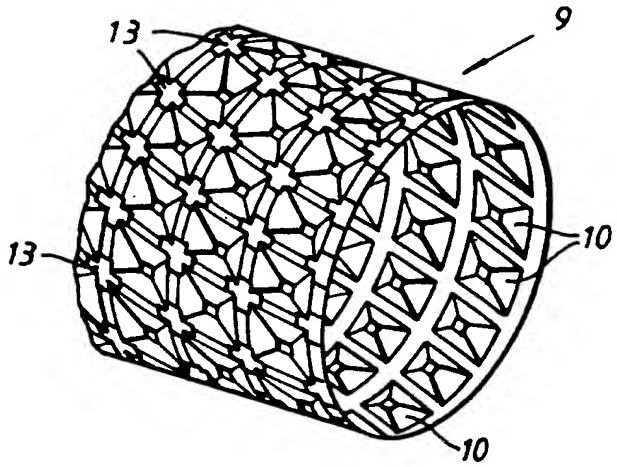
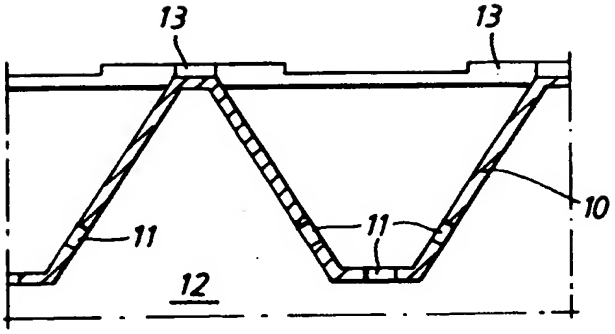


Fig. 5



INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 94/00150

A. CLASSIFICATION OF SUBJECT MATTER

IPC : A61F 13/02, A61F 13/15
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC : A61F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US, A, 3602220 (JOHN BUNYAN), 31 August 1971 (31.08.71) --	1-3,5
X	WO, A1, 9111161 (SMITH & NEPHEW PLC), 8 August 1991 (08.08.91) --	1-5
Y	US, A, 4704112 (SUZUKI ET AL), 3 November 1987 (03.11.87), column 5, line 63 - line 64, figures 6,7 --	6-7

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
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International application No.
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP, A2, 0057484 (THE PROCTER & GAMBLE COMPANY), 11 August 1982 (11.08.82) --	6-7

INTERNATIONAL SEARCH REPORT

Information on patent family members

07/05/94

International application No.
PCT/SE 94/00150

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A- 3602220	31/08/71	NONE	
WO-A1- 9111161	08/08/91	AU-A- 7073491	21/08/91
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		SE-T3- 0235309	
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		JP-C- 1677735	13/07/92
		JP-B- 3040697	19/06/91
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		US-A- 4509908	09/04/85